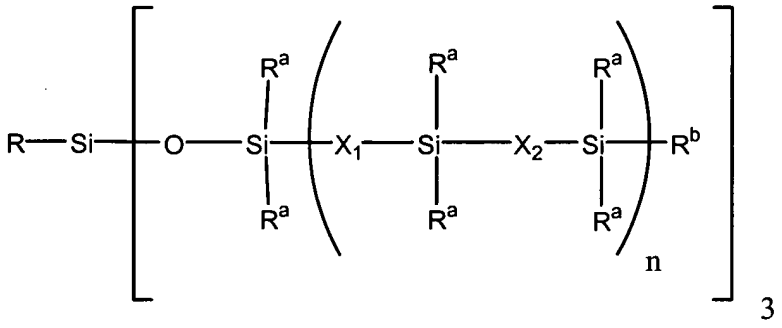
CLAIMS

What is claimed is:

1. A compound represented by the following structural formula:



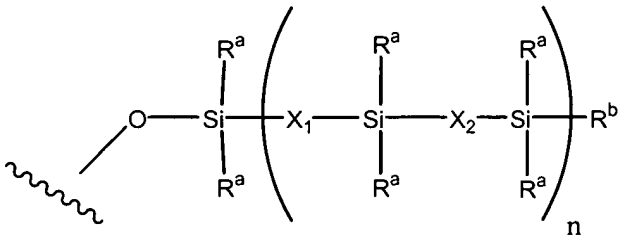
wherein:

X_1 and X_2 are independently each an inert linking group;

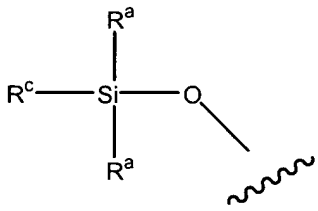
each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

n is 1, 2, 3 or 4;

R is a substituted or unsubstituted aliphatic group, a substituted or unsubstituted aryl group or is represented by a structural formula selected from:



or



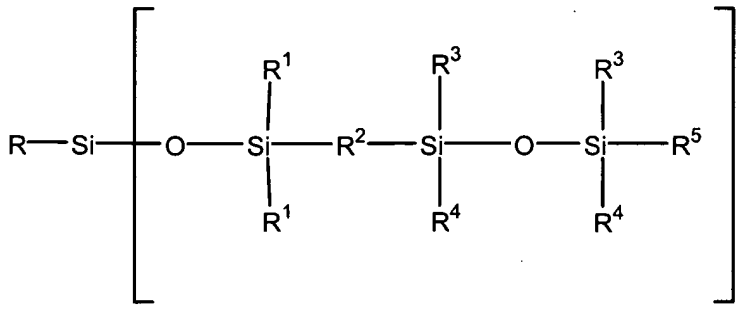
;

each R^b is independently an epoxide substituted aliphatic group; and

R^c is H, an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group, a substituted siloxane group, an unsubstituted siloxane group, a substituted polysiloxane group or an

unsubstituted polysiloxane group.

2. The compound of Claim 1 wherein the compound is represented by the following structural formula:



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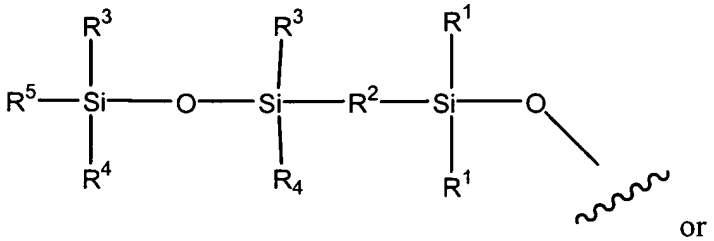
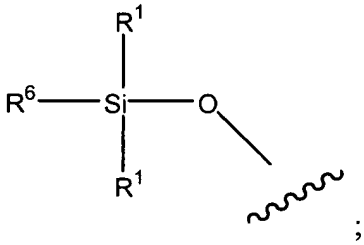
wherein R is represented by a structural formula selected from:



or



;

wherein:

each group R^1, each group R^3 and each group R^4 is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each group R^2 is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, $-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or $-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each group R^5 is independently, an epoxide substituted aliphatic group having 2-10 carbon atoms; and

each group R^6 is independently hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or R^z-$(O\text{-}Y_1)_m$-, $(R^z)_3Si$-$(O\text{-}Si(R^z)_2)_q$-Y_1- or $(R^z)_3Si$-$(O\text{-}Si(R^z)_2)_q$-O-;

each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

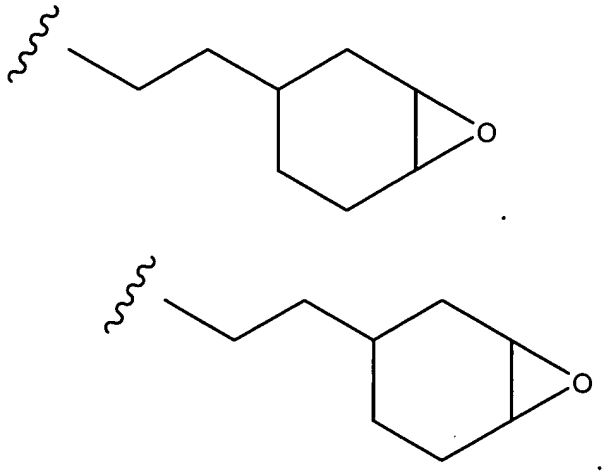
each Y_1 is independently a C_{1-12} alkylene group;

p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

3. The compound of Claim 2 wherein each group R^2 is independently, a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} substituted arylalkylene, or arylene group; and each R^6 is independently a substituted or unsubstituted C_{1-12} alkylsilane, C_{1-12} cycloalkylsilane, C_{1-12} alkoxysilane, aryl substituted C_{1-12} alkylsilane, a hydrogen, a vinyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} dialkylether, (C_{1-12} cycloalkyl)C_{1-12} alkylether, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group.

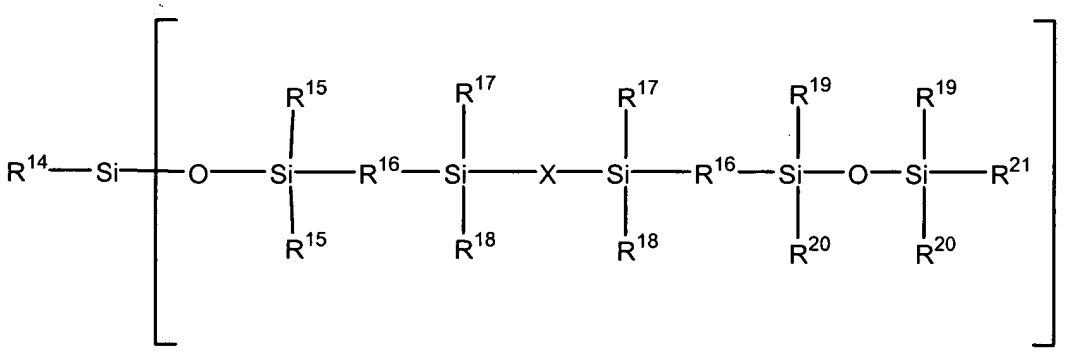
4. The compound of Claim 3 wherein at least one R^5 comprises a cycloalkene oxide.

5. The compound of Claim 3 wherein each R^5 is represented by the following structural formula:

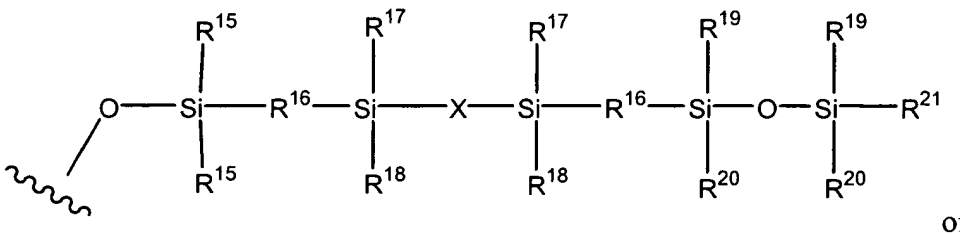


6. The compound of Claim 3 wherein R^1 is a methyl group; each group R^2 is an ethylene, hexylene, or octylene group; each group R^3 is a methyl group; each group R^4 is a methyl group; each group R^5 is a 2-(3,4-epoxycyclohexyl) ethyl grouping, and each group R^6 is a hydrogen or ethenyl.

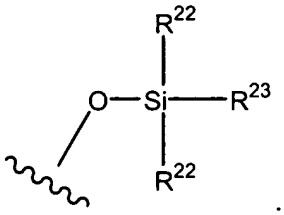
7. The compound of Claim 1 wherein the compound is represented by the following structural formula:



wherein R^{14} is represented by a structural formula selected from:



or



;

each group R^{15}, each group R^{17}, each group R^{18}, each group R^{19}, each group R^{20} and each group R^{22} is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each group R^{16} is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, $-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or $-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each R^{21} is independently an epoxide substituted aliphatic group having 2-10 carbon atoms;

R^{23} is independently hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or $R^z-(O-Y_1)_m-$, $(R^z)_3Si-(O-Si(R^z)_2)_q-Y_1-$ or $(R^z)_3Si-(O-Si(R^z)_2)_q-O-$;

each group X is independently oxygen or R^{16};

each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

each Y_1 is independently a C_{1-12} alkylene group;

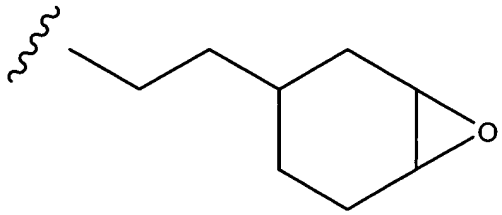
p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

8. The compound of Claim 7 wherein each group R^{16} is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, aryl substituted C_{1-12} alkylene or arylene group; R^{23} is, independently, a hydrogen, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} dialkylether

(alkyl-O-alkylene-), C_{1-12} cycloalkyl C_{1-12} alkylether, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group; and X is oxygen.

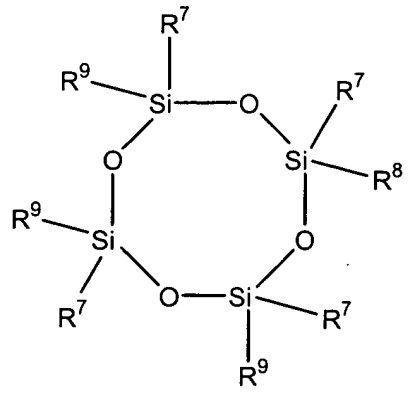
9. The compound of Claim 8 wherein at least one R^{21} comprises a cycloalkene oxide.

10. The compound of Claim 9 wherein each is R^{21} represented by the following structural formula:



11. The compound of Claim 10 wherein: each group R^{15}, R^{17}, R^{18} R^{19}, R^{20} and R^{22} is a methyl group; each group R^{16} is an ethylene, hexylene, or octylene group; and R^{23} is a hydrogen, hexyl, or alkylether.

12. A compound represented by the following structural formula:



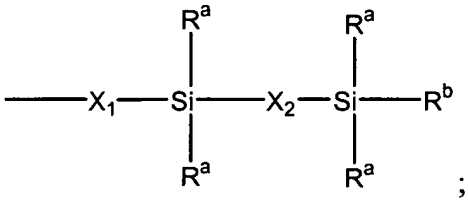
wherein:

each group R^7 is an unsubstituted aliphatic group, a substituted aliphatic

group, an unsubstituted aryl group, a substituted aryl group;

each group R^8 is R^9, hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or R^z-$(O\text{-}Y_1)_m$-, $(R^z)_3Si$-$(O\text{-}Si(R^z)_2)_q$-Y_1- or $(R^z)_3Si$-$(O\text{-}Si(R^z)_2)_q$-O-;

each R^9 is independently represented by the following structural formula:



;

wherein:

X_1 and X_2 are independently an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

each R^b is an aliphatic group substituted with an epoxide;

each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

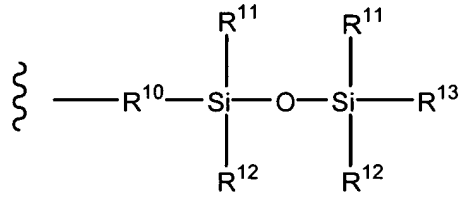
each Y_1 is independently a C_{1-12} alkylene group;

m is an integer from 1 to 10; and q is an integer from 0 to 4.

13. The compound of Claim 12 wherein:

each R^7 is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each R^9 is represented by



each group R^{10} is independently a substituted or unsubstituted C_{1-12}

alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, $-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or $-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each R^z is independently a C_{1-12} alkyl group;

each Y_1 is independently a C_{1-12} alkylene group;

each group R^{11} and R^{12} is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl group or aryl group; and

each group R^{13} is independently an epoxide substituted aliphatic group having from 2-10 carbon atoms.

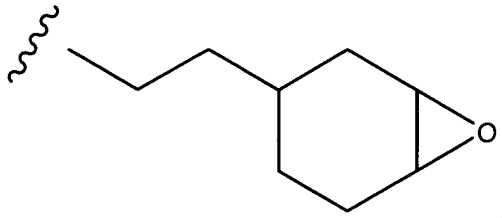
14. The compound of Claim 13 wherein:

R^8 is substituted or unsubstituted C_{1-12} alkylsilane, C_{1-12} cycloalkylsilane, C_{1-12} alkoxysilane, arylsubstituted C_{1-12} alkyl silane or a substituted or unsubstituted 1-alkenyl group or a substituted or unsubstituted C_{1-12} *n*-alkenyl group where *n* is greater than or equal to 1;

R^{10} is independently a C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group.

15. The compound of Claim 14 wherein at least one group R^{13} comprises a cycloalkene oxide.

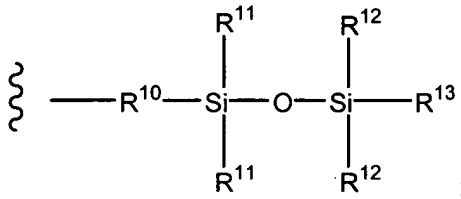
16. The compound of Claim 15 wherein each R^{13} is represented by the following structural formula:



17. The compound of Claim 14 wherein:

R^7 is a methyl group,

R^8 is ethenyl or R^9;

each R^9 is  ;

each group R^{10} is $-(CH_2)_2-$, $-(CH_2)_6-$ or $-(CH_2)_8-$;

each group R^{11} and R^{12} are a methyl group; and

each group R^{13} is a 2-(3,4-epoxycyclohexyl) ethyl group.

18. A holographic recording medium comprising:

a) at least one polyfunctional epoxide monomer or oligomer which undergoes acid initiated cationic polymerization, wherein: 1) each epoxide in the monomer or oligomer is connected by a linker group comprising a siloxane to a silicon atom; or 2) each epoxide in the monomer or oligomer is connected by a linker group to a central polysiloxane ring; and each monomer or oligomer has an epoxy equivalent weight of greater than about 300 g/mole epoxide;

b) a binder which is capable of supporting cationic polymerization;

c) an acid generator capable of producing an acid upon exposure to actinic radiation; and optionally

d) a sensitizer.

19. The holographic recording medium of Claim 18, additionally comprising a difunctional epoxide monomer.

20. The holographic recording medium of Claim 18, additionally comprising a monofunctional epoxide monomer.

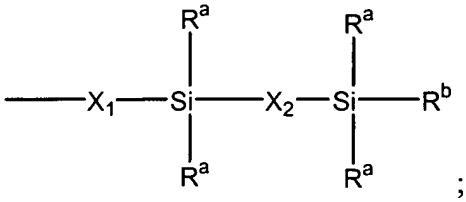
21. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer or oligomer is represented by the following structural formula:

$$R''\text{-}Si\text{-}R'_3$$

wherein each R' independently comprises an aliphatic group substituted with epoxide, said aliphatic group being connected to the silicon atom by a linker comprising a siloxane group; and

R" is R' or –H, a substituted aliphatic group, an unsubstituted aliphatic group, a substituted aryl group, an unsubstituted aryl group a substituted siloxane group, an unsubstituted siloxane group, a substituted polysiloxane group or an unsubstituted polysiloxane group.

22. The holographic recording medium of Claim 21 wherein each R' comprises a group represented by the following structural formula:



;

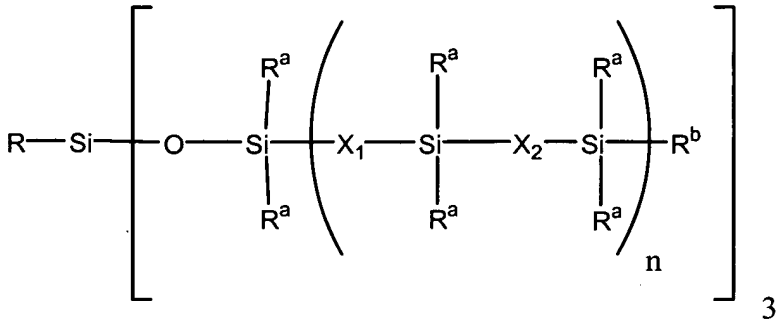
wherein:

X_1 and X_2 are independently an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group; and

each R^b is an aliphatic group substituted with an epoxide.

23. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer is by the following structural formula:



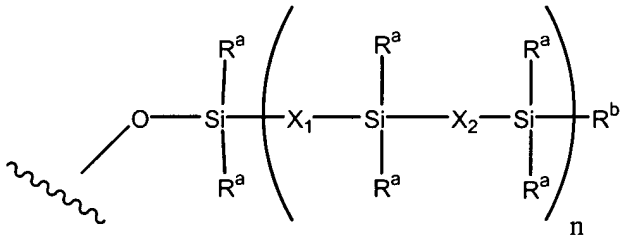
wherein:

X_1 and X_2 are independently each an inert linking group;

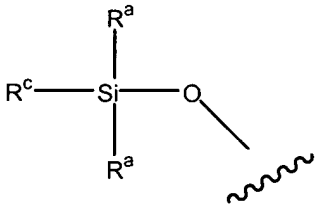
each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

n is 1, 2, 3 or 4;

R is a substituted or unsubstituted aliphatic group, a substituted or unsubstituted aryl group or is represented by a structural formula selected from:



or



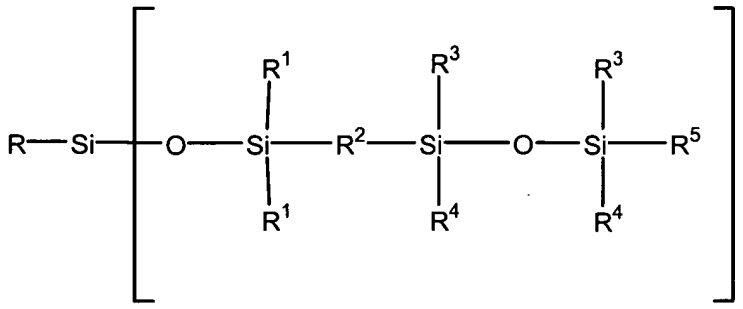
;

each R^b is independently an epoxide substituted aliphatic group; and

R^c is H, an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group, a substituted siloxane group,

an unsubstituted siloxane group, a substituted polysiloxane group or an unsubstituted polysiloxane group.

24. The holographic recording medium of Claim 23 wherein the polyfunctional epoxide monomer is represented by the following structural formula:



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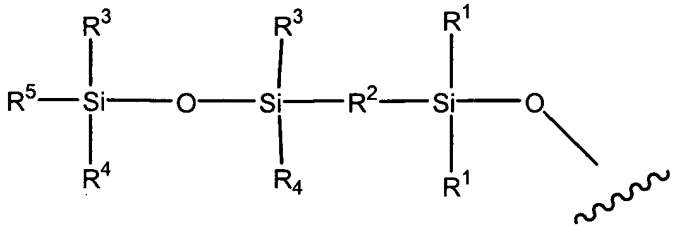
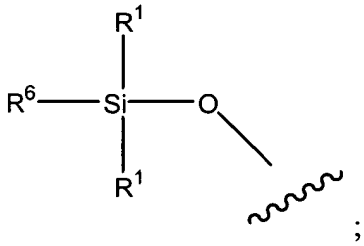
wherein R is represented by a structural formula selected from:



or



;

wherein:

each group R^1, each group R^3 and each group R^4 is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each group R^2 is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, -$-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or –

Y_1-$Si(R^z)_2$-Y_1-$Si(R^z)_2$-Y_1-;

each group R^5 is independently, an epoxide substituted aliphatic group having 2-10 carbon atoms; and

each group R^6 is independently hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or R^z-$(O$-$Y_1)_m$-, $(R^z)_3Si$-$(O$-$Si(R^z)_2)_q$-Y_1- or $(R^z)_3Si$-$(O$-$Si(R^z)_2)_q$-O-;

each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

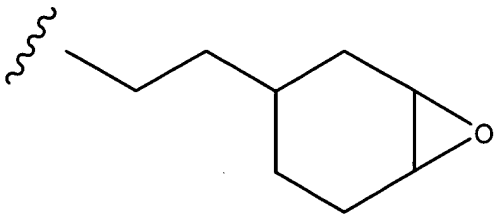
each Y_1 is independently a C_{1-12} alkylene group;

p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

25. The holographic recording medium of Claim 24 wherein each group R^2 is independently, a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, aryl substituted C_{1-12} alkylene, or arylene group each R^6 is independently a monovalent substituted or unsubstituted C_{1-12} alkylsilane, C_{1-12} cycloalkylsilane, C_{1-12} alkoxysilane, aryl substituted C_{1-12} alkylsilane, a hydrogen, a vinyl, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} dialkylether, (C_{1-12} cycloalkyl)C_{1-12} alkylether, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group.

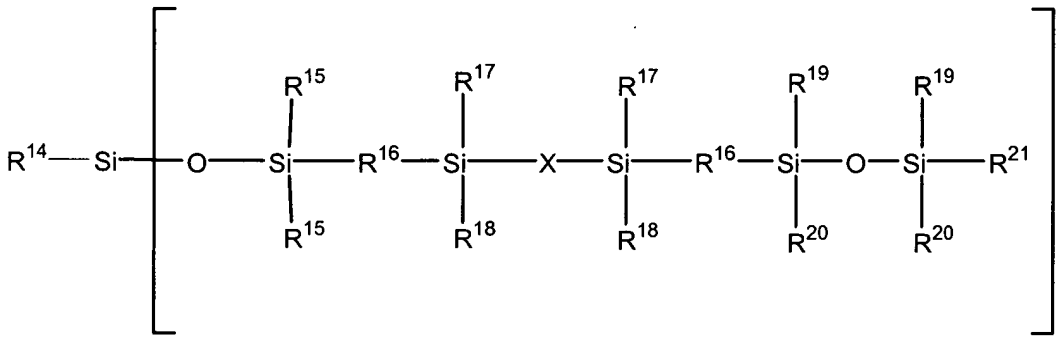
26. The holographic recording medium of Claim 25 wherein at least one R^5 comprises a cycloalkene oxide.

27. The holographic recording medium of Claim 26 wherein each R^5 is represented by the following structural formula:



28. The holographic recording medium of Claim 27 wherein R^1 is a methyl group; each group R^2 is an ethylene, hexylene, or octylene group; each group R^3 is a methyl group; each group R^4 is a methyl group; each group R^5 is a 2-(3,4-epoxycyclohexyl) ethyl grouping, and each group R^6 is a hydrogen or ethenyl.

29. The holographic recording medium of Claim 23 wherein the polyfunctional epoxide monomer is represented by the following structural formula:



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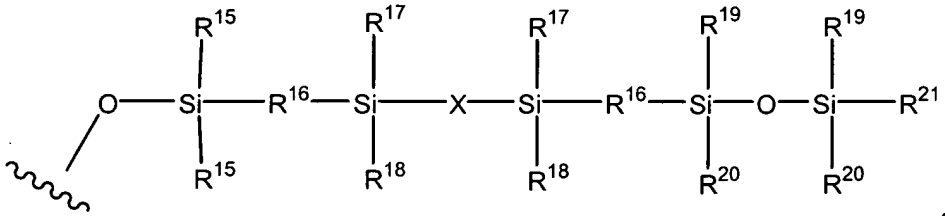
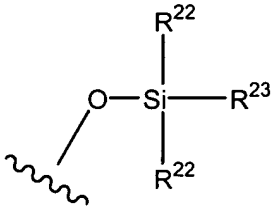
wherein R^{14} is represented by a structural formula selected from:



or



;

each group R^{15}, each group R^{17}, each group R^{18}, each group R^{19}, each group R^{20} and each group R^{22} is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each group R^{16} is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, $-Y_1-[O-Y_1]_p-$, $-Y_1-Si(R^z)_2-Y_1-$, $-Y_1-Si(R^z)_2-Y_1-O-Y_1-Si(R^z)_2-Y_1-$, or $-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each R^{21} is independently an epoxide substituted aliphatic group having 2-10 carbon atoms;

R^{23} is independently hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or $R^z-(O-Y_1)_m-$, $(R^z)_3Si-(O-Si(R^z)_2)_q-Y_1-$ or $(R^z)_3Si-(O-Si(R^z)_2)_q-O-$;

each group X is independently oxygen or R^{16};

each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

each Y_1 is independently a C_{1-12} alkylene group;

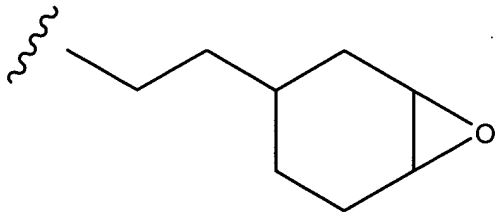
p is an integer from 1 to 5; m is an integer from 1 to 10; and q is an integer from 0 to 4.

30. The holographic recording medium of Claim 29 wherein each group R^{16} is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene or arylene group; R^{23} is, independently, a hydrogen, a monovalent substituted or unsubstituted C_{1-12} alkyl, C_{1-12} dialkylether (alkyl-O-alkylene-), C_{1-12} cycloalkyl C_{1-12} alkylether, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group; and X is oxygen.

31. The holographic recording medium of Claim 30 wherein wherein at least one

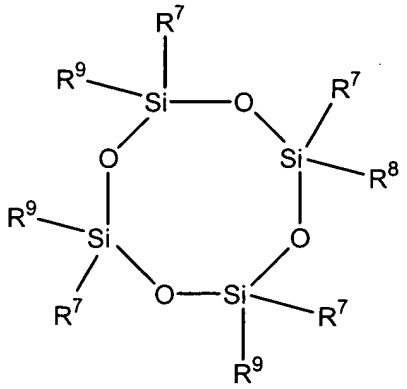
R^{21} comprises a cycloalkene oxide.

32. The holographic recording medium of Claim 31 wherein each is R^{21} represented by the following structural formula:



33. The holographic recording medium of Claim 32 wherein each group R^{15}, R^{17}, R^{18} R^{19}, R^{20} and R^{22} is a methyl group; each group R^{16} is an ethylene, hexylene, or octylene group; and R^{23} is a hydrogen, hexyl, or alkylether.

34. The holographic recording medium of Claim 18 wherein the polyfunctional epoxide monomer is represented by the following structural formula:



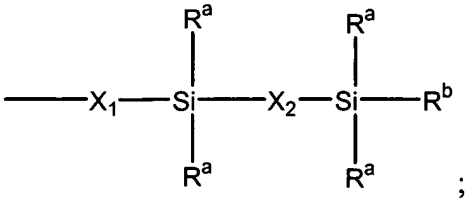
wherein:

each group R^7 is an unsubstituted aliphatic group, a substituted aliphatic group, an unsubstituted aryl group, a substituted aryl group;

each group R^8 is R^9, hydrogen, an alkenyl, a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12}-alkyl or aryl or

R^z-(O-Y_1)$_m$-, (R^z)$_3$Si-(O-Si(R^z)$_2$)$_q$-Y_1- or (R^z)$_3$Si-(O-Si(R^z)$_2$)$_q$-O-;

each R^9 is independently represented by the following structural formula:



;

wherein:

X_1 and X_2 are independently an inert linking group;

each R^a is independently a substituted or unsubstituted aliphatic group or a substituted or unsubstituted aryl group;

each R^b is an aliphatic group substituted with an epoxide;

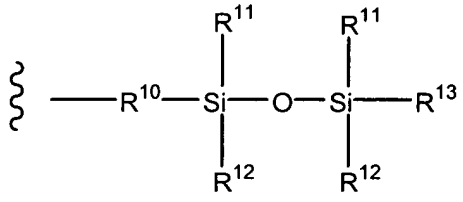
each R^z is independently a substituted or unsubstituted C_{1-12} alkyl group, C_{1-12} cycloalkylalkyl group, aryl substituted C_{1-12} alkyl group or aryl group;

each Y_1 is independently a C_{1-12} alkylene group;

m is an integer from 1 to 10; and q is an integer from 0 to 4.

35. The holographic recording medium of Claim 34 wherein the polyfunctional epoxide monomer is represented by the following structural formula:

each R^7 is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl or aryl group;

each R^9 is represented by 

each group R^{10} is independently a substituted or unsubstituted C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group, -Y_1-[O-Y_1]$_p$-, -Y_1-Si(R^z)$_2$-Y_1-, -Y_1-Si(R^z)$_2$-Y_1-O-Y_1-Si(R^z)$_2$-Y_1-, or

$-Y_1-Si(R^z)_2-Y_1-Si(R^z)_2-Y_1-$;

each R^z is independently a C_{1-12} alkyl group;

each Y_1 is independently a C_{1-12} alkylene group;

p is an integer from 1 to 5;

each group R^{11} and R^{12} is independently a substituted or unsubstituted C_{1-12} alkyl, C_{1-12} cycloalkyl, aryl substituted C_{1-12} alkyl group or aryl group; and

each group R^{13} is independently an epoxide substituted aliphatic group having from 2-10 carbon atoms.

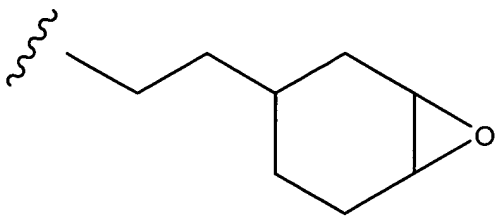
36. The holographic recording medium of Claim 35 wherein:

R^8 is substituted or unsubstituted C_{1-12} alkylsilane, C_{1-12} cycloalkylsilane, C_{1-12} alkoxysilane, arylsubstituted C_{1-12} alkyl silane or a substituted or unsubstituted 1-alkenyl group or a substituted or unsubstituted C_{1-12} *n*-alkenyl group where *n* is greater than or equal to 1;

R^{10} is independently a C_{1-12} alkylene, C_{1-12} cycloalkylene, C_{1-12} arylalkylene, or arylene group.

37. The holographic recording medium of Claim 36 wherein at least one group R^{13} comprises a cycloalkene oxide.

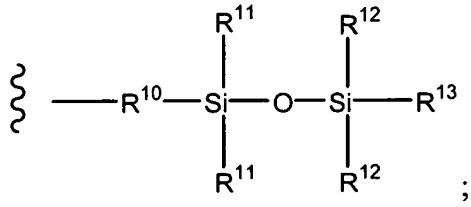
38. The holographic recording medium of Claim 37 wherein each R^{13} is represented by the following structural formula:



39. The holographic recording medium of Claim 38 wherein:

R^7 is a methyl group,

R^8 is -ethenyl or R^9;

each R^9 is  ;

each group R^{10} is–$(CH_2)_2$-, -$(CH_2)_6$- or –$(CH_2)_8$-;

each group R^{11} and R^{12} are a methyl group; and

each group R^{13} is a 2-(3,4-epoxycyclohexyl) ethyl group.

40. The holographic recording medium of Claim 19 wherein the difunctional epoxide monomer is represented by the following structural formula:

$$R^{24}Si(R^{25})_2OSi(R^{26})_2R^{24}$$

where each group R^{24} is a 2-(3,4-epoxycyclohexyl)ethyl grouping; each grouping R^{25} is a methyl group, and each group R^{26} is a methyl group.

41. The holographic recording medium of Claim 18 wherein the holographic medium comprises between about 0.25 to about 5 parts by weight of the difunctional epoxide monomer per part by weight of the polyfunctional epoxide monomer.

42. The holographic recording medium of Claim 18 wherein the holographic medium comprises from about 90 parts binder and 10 parts monomer or oligomer (w/w) to about 10 parts binder and 90 parts monomer or oligomer (w/w).

43. The holographic recording medium of Claim 18 wherein the acid generator capable of producing an acid upon exposure to actinic radiation is a diaryliodonium salt.

44. A holographic recording medium of Claim 18 wherein the sensitizer is 5,12-*bis*(phenylethynyl)naphthacene.